Lakesh K. Sharma

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CURRENT POSITION:

September 2015 – Present
Assistant Professor Extension & Sustainable Ag
University of Maine, Cooperative Extension

ACADEMIC BACKGROUND:

2014 **Ph.D., Department of Soil Science,** North Dakota State University, Fargo, ND.
Thesis title: Evaluation of active optical sensor for yield prediction in corn (*Zea mays,* L**).**

2007 **MS Horticulture,** Punjab Agricultural University, Ludhiana, India.
Major-Horticulture, Minor-Botany
Thesis Title: Evaluate the direct sown and transplanted rough lemon (*Citrus jambhiri* Lush.) seedlings under modified environmental conditions.

2005 **BS in Agriculture (Hons.)**, Guru Nanak Dev University, Amritsar, India.

EMPLOYMENT EXPERIENCE:

Year	Position	Employer
2015-present	Assistant Professor Extension & Sustainable Ag	University of Maine Cooperative Extension and the University of Maine At Presque Isle
2014-2015	Post-Doctoral Fellow	North Dakota State University
2012-2013	Teaching Assistant	North Dakota State University
2011-2014	Graduate Research Assistant	North Dakota State University
2010-2011	Graduate Research Assistant	Texas A & M, College Station
2008-2010	Research Fellow	Punjab Agricultural University, Ludhiana
2005-2007	Graduate Research Assistant	Punjab Agricultural University, Ludhiana

MEMBERSHIPS IN PROFESSIONAL ORGANIZATIONS, SOCIETIES, AND CLUBS:

- American Society of Agronomy, *2011-Present* (Precision Agriculture Community Vice Leader)
- Crop Science Society of America, *2011-Present*
- Soil Science Society of America, *2011-Present*
- Potato Association of America, *2015-Present*
- Gamma Sigma Delta – "The Honor Society of Agriculture" (Permanent Membership, 2014)
- Phi Kappa Phi Science Honor Society, *2012-Present* (Invited member, Advertising Officer)
- International Society of Precision Agriculture, *2016-Present*
- International Nutrient Use Efficiency Group
- Canadian Soil Science Society, *2013-2014*
- Soil Science Club, NDSU, *2012-2015*
- Graduate Student Association, NDSU, *2011-2014*
- International Student Association, NDSU, *2011-2014*
- Organization of Students from India, NDSU, *2011-2014*
- Lions Club Sunam, India, *2002-2010*
- Nettar Bank Samiti (Eye Donation Organization, India), *2008-2009*
- Bharat Vikas Parishad (Indian Development Organization), *2004-2010*

HONORS AND AWARDS:

- Outstanding Graduate Student Award, North-Central Soil Fertility Conference, 2013
- Frank Bain Graduate Student Scholarship NDSU, School of Natural Resource Science, 2013-2014
- NDSU Soil Science Roy A. Erickson Scholarship Award, 2012-2013
- First prize in graduate student poster competition conducted by Sensor Community at International ASA-CSSA-SSSA conference
- Awarded with first prize at Graduate student poster competition in Research and Art Forum, NDSU, 2013
- Awarded travel grant from NDSU Graduate School to attend the Canadian Soil Science Annual Meeting Conference, Winnipeg, Manitoba, July 2013
- Awarded travel grant from NDSU Graduate School to attend the ASA-CSSA-SSSA Conference, Tampa, FL, 2013
- Awarded travel grant from NDSU Graduate School to attend the ASA-CSSA-SSSA Conference, Cincinnati, OH, 2012
- Nominated for IPNI Scholar student award for the year 2012-2013 and 2013-2014 by Dr. D.W. Franzen (Ph.D. Advisor)

EVALUATION/REVIEW OF OTHER'S WORK:

- Associate Editor *Agronomy Journal*
- Moderator and judge for 2016 ASA-CSSA-SSSA meeting

- Judge for graduate student oral and poster competition at 2015 ASA-CSSA-SSSA meeting
- Judge at undergraduate student poster competition at UMPI student day 2016
- Reviewer for NIH agriculture funding program, 2016
- Reviewer for NDSU agriculture funding program, 2016
- Reviewing research manuscripts for: American Journal of Agronomy; Journal of Crop Improvment; Sensor Journal; Remote Sensing Journal; Journal of Plant and Soil Science; and Journal of Applied Science.

SIGNIFICANT TEACHING EXPERIENCE:

The University of Maine at Presque Isle, Fall 2015 - Present

- ENV 200 - Introduction to Sustainable Agriculture: This course covers ecological, economic, and political factors that impact sustainable agriculture. Case studies illustrate the challenges, obstacles, and successes of transitioning to sustainable agricultural practices. The course emphasizes fundamental sustainability components that support local farmers, economies, communities, and ecosystems.

- ENV 210 - Introduction to Soils: This course provides an introduction to soil science intended for environmental resource managers engaged in agriculture, forestry, site evaluation, and related fields. Students will become familiar with the basic terminology of soil properties and processes, understand the importance of soils as an ecosystem and agricultural components, develop knowledge of soil resources which can be applied to their careers as natural resource professionals, and develop a basic competence in soil science which can be applied to professional credentialing exams.

- ENV 220 - Integrated Pest Management: The course provides an introduction to soil science intended for environmental resource managers engaged in agriculture, forestry, site evaluation, and related fields. The learning objectives of this course are to: define the tradeoffs of IPM versus conventional pest management systems; apply economic analysis and sampling to decisions regarding pest management; apply ecological, biological, and genetic principles to applied pest management; and understand the role of and tradeoffs associated with biological control and biotechnology approaches to pest management.

North Dakota State University, Spring/Fall 2013

- Teaching Assistant/Lecturer – "Introduction to Soils" Laboratory (Soil-210) North Dakota State University, Spring and Fall 2013. Dr. R. Jay Goos, principle instructor. As lab instructor, responsibilities included teaching students the physical, biological, and chemical aspects of soil management and interactions between soil, water, organisms and chemical inputs effects on soil health, water quality and quantity, sustainability. Emphasized soil classification and laboratory soil analyses. Responsible for lab setup, lectures, and aiding students during lab experiments.

EXTENSION AND GUEST LECTURES:

- Soil Fertility for Beginning Crop Consultants for Eastern scout school workshop, 2015.

- Sensor research and algorithm development for corn in ND at International nitrogen use efficiency conference 2014 at South Dakota State University http://www.nue.okstate.edu/Nitrogen_Conference2014/South_Dakota.htm.
- Tillage, Nitrogen movement, remote sensing, precision Ag lecture for Bismarck and Wahpeton college undergraduate students, 2014.
- Algorithms for Use in Directing In-season N Rates for Corn at Soil and Soil Water Workshop North Dakota, January, 2014 (250 Growers and Crop Consultants).
- Active Optical sensors and its Algorithms for Directing In-season N Rates for Corn 2014 at Wahpeton College of Science. (100 students attended).
- Remote sensing and its application in soil fertility management under North Dakota conditions for Soil 721. (20 graduate students).
- Active-optical sensors as yield prediction tools for corn- at Soil and Soil Water Workshop North Dakota, January 2013.
- Soil tillage system, drainage system, cultivation system, and new agriculture technologies- to the students from Bismarck State College, July 2012 and July 2013 (90 attending).
- Fertilizer nutrient transformations and novel products- Western Crop and Pest Management School Workshop, February 2013, Mandan, ND (200 Growers and Crop Consultants).
- The importance of intellectual property rights for farmers at Bathinda Research Station, Punjab Agricultural University, Ludhiana, India (50 Farmers).
- Nutrient management of horticulture crop- 2009, to undergraduate students at Department of Fruit Science, Punjab Agricultural University (15 students).

SIGNIFICANT OUTREACH/MENTORSHIP EXPERIENCE:

- **Sustainable Agriculture Field Day:** Organized a field day at Aroostook Research Farm for Maine growers and industry to educate them about UMaine research and extension activities. Growers learned about potential rotation crops, potato fertility management, precision agriculture, new potato varieties and update on Dickeya's presence in Maine.

- **Mentor:** Supervised two undergraduate students and assisted two master's students as a research fellow. Assisted mentees with finding appropriate research problems, writing a synopsis of research, statistical design selection, research data collection and analysis, and research presentations.

PUBLICATIONS:

Peer Reviewed Publications

1. Sharma LK, SK Bali, J Dwyer, AB Plant, Bhowmik A. A case study of improving yield prediction and sulfur deficiency detection using optical sensors under variable climatic conditions in dryland potato cultivation in Maine. 2017. *Sensors* **2017**, *17*(5), 1095; doi:10.3390/s17051095.

2. Shultz, EC, **L.K. Sharma**, G Enders, R Ashley, H Bu, S Markell, A Kraklau, Franzen DW. The response of sunflower to nitrogen and phosphorus fertilization in North Dakota. 2017 Submitted to Agronomy Journal.

3. Bu H, **L.K. Sharma**, A Denton, Franzen DW. Comparison of Satellite Imagery and Ground-Based Active Optical Sensors As Yield Predictors In Sugar Beet, Spring Wheat, Corn, And Sunflower. 2017 Agron. J. 109:1–10.

4. **Sharma L.K.**, H Bu, A Denton, Franzen DW. Evidence for the Ability of Active-Optical Sensors to Detect Sulfur Deficiency in Corn. 2016 Agron. J. 108:1–5. doi:10.2134/agronj2016.05.0287.

5. **Sharma L.K.**, H Bu, DW Franzen, Denton A. Use of corn height measured with an acoustic sensor improves yield estimation with ground-based active optical sensors. Computers and Electronics in Agriculture. 2016 Volume 124, June 2016, Pages 254–262.

6. Bu H., **L.K. Sharma**, A Denton, Franzen DW. Sugar Beet Yield and Quality Prediction at Multiple Harvest Dates Using Active-Optical Sensors. Agronomy Journal 2016 108:273–284.

7. **Sharma L.K.**, H Bu, A Denton, Franzen DW. Active-optical sensors using red NDVI compared to red edge NDVI for prediction of corn grain yield in North Dakota, U.S.A Sensor Journal. 2015 Nov 2;15 (11):27832-53.

8. L.K. Sharma, A. Plant, J Dwyer, and D.W. Franzen. 2016. An Introduction to Using Site-Specific Farming to Manage Field Variability. UMaine Extension Bulletin #1080.

9. Franzen DW, **L.K. Sharma**, Bu H. Active optical sensor algorithm for corn yield prediction and corn side dress nitrogen rate aid. NDSU Extension publication. 2014 SF1176-5.

10. **Sharma L.K.**, H Bu, Franzen DW. Comparison of two ground-based active-optical sensors, GreenSeeker® and Holland crop circle® acs-470, for in-season estimation of the yield of corn (*Zea mays,* L). Journal of Plant Nutrition. 2015 39:7, 957-966.

11. **Sharma L.K.**, Franzen DW. Use of corn height to improve the relationship between active optical sensor readings and yield estimates. Precision Ag Journal. 2014 15: 331.

12. Kaur M, JS Bal, **L.K. Sharma**, Bali SK. An evaluation of mango germplasm for the future breeding program. African Journal of Agriculture research. 2013 Vol. 9 pp 1530-38.

13. **Sharma L.K.**, M Kaushal, SK Bali, Choudhary OP. Evaluation of rough lemon, (*Citrus jambhiri* Lush.), as rootstock for salinity tolerance at seedling stage under in-vitro conditions. African Journal of biotechnology. 2013 Vol. 12(44), pp. 6267-6275.

14. Dhaliwal, H.S., A.K. Banke, **L.K. Sharma,** and S.K. Bali. 2013. Impact of pruning practices on shoot growth and bud production in kinnow (*Citrus reticulata* Blanco) plants. Journal of Experimental Biology and Agricultural Sciences, January - 2014; Volume – 1 (7 - Special Issue on soil and water management in agriculture).

15. **Sharma, L.K.** and H. S. Dhaliwal. 2013. Germination and growth of rough lemon (*Citrus jambhiri* Lush.) seedlings under protected environment. *J. Hortl. Sci.* Vol. 8(1):91-94, 2013.

16. Dhaliwal, H.S., **L.K. Sharma,** A.K. Banke, J.S. Brar, and S.K. Bali. 2013. Investigations on Growth Behaviour of 'Kinnow' (*Citrus reticulata*) Mother Plants Pruned at Different Intensities. Middle-East Journal of Scientific Research 16 (1): 135-140. DOI: 10.5829/idosi.mejsr.2013.16.01.11633.

17. **Sharma, L.K.**, M. Kaushal, M.I.S. Gill, and S.K. Bali. 2013. Germination and survival of citrus jambhiri seeds and epicotyls after treating with different mutagens under in vitro conditions. Middle-East Journal of Scientific Research 16 (2): 250-255. DOI: 10.5829/idosi.mejsr.2013.16.02.11634.

18. **Sharma, L.K.** and H.S. Dhaliwal. 2009. Effect of raising rough lemon (Citrus jambhiri Lush.) on budding success under modified environmental conditions. J Res-Punjab Agric. Univ. 2009, 46(1-2), 50-1.

Edited Publication

1. Franzen, D.W., H. Bu, **L.K. Sharma**, N.R. Cattanach, A. Denton, and A. Chatterjee. 2013. Use of active-optical sensors for early season prediction of sugarbeet yield and quality. www.sbreb.org.

Proceedings

1. **Sharma, L.K.**, Franzen, D.W., Bu, H. Evaluation of wavelength from ground-based active optical sensors for corn yield prediction in North Dakota. In Proceedings of the 43rd North Central Extension-Industry Soil Fertility Conference. Des Moines, IA, USA, November 20–21, 2013.

2. Bu, H., D.W. Franzen, and **L.K. Sharma**. 2013. Crop yield relationship to remote sensing data using intensified weighted nonlinear regression models. Proceedings of Northcentral Soil Fertility Meeting at Des Moines, Iowa.

3. Franzen, D.W. and **L.K. Sharma** 2012. Use of corn height to improve the relationship between active optical sensor readings and yield estimates. Proceedings paper/presentation at the North Central Extension-Industry Soil Fertility Conference, November 2012, Des Moines, IA.

4. Kaushal, M., **L.K. Sharma**, M.I.S. Gill, O.P. Choudhary, and S.K. Bali. 2013. Effect of salinity on survival and growth performance of in vitro grown rough lemon (*Citrus jambhiri* Lush.) seeds. Indian Journal of Biotechnology Vol 12, April 2013, pp. 284-286.

5. Dhaliwal, H.S. and **L.K. Sharma.** 2012. Effect of direct sown and transplanted rough lemon (*Citrus jambhiri* Lush.) seedlings on chlorophyll and dry matter content under modified environmental conditions. Crop Improvement 39 pp. 609-610.

6. **Sharma L.K.** and H. S. Dhaliwal. 2012. Growth performance of direct sown and transplanted rough lemon (*Citrus jambhiri* Lush.) seedlings under modified environmental conditions. Crop Improvement 39 p 641-642.

Posters, Presentations, and Short Communications

1. **L.K. Sharma**, S.K. Bali, and J. Dwyer. 2017. Study of Improving Yield Prediction and Sulfur Deficiency Detection Using Optical Sensors. ASA-CSSA-SSSA, Madison, WI (Oral).

2. **L.K. Sharma**, S.K. Bali, A.A. Zaeen and J. Dwyer. 2017. Potential Reasons of Increased New England States Phosphorus Pollution: A Review. ASA-CSSA-SSSA, Madison, WI (Poster).

3. **L.K. Sharma**, S.K. Bali, A.A. Zaeen and J. Dwyer. 2017. Evaluate Different N Fertilizers to Improve Nitrogen Use Efficiency, Yield, and Quality of Potato Cultivation Under Rainfed and Irrigated Fields. ASA-CSSA-SSSA, Madison, WI (Oral).

4. S.K. Bali, **L.K. Sharma,** and J. Dwyer. 2017. Effect of fly ash on agriculture production as soil amendments. ASA-CSSA-SSSA, Madison, WI (Poster).

5. J. Breker, T. DeSutter, A. Chatterjee, M Rakkar, **L.K. Sharma**, E. Schultz, and D.W. Franzen. 2017. Potassium recommendations for corn in North Dakota: influence of clay chemistry

6. **L.K Sharma**. 2017. Maine soil and agronomy workshop booklet. UMaine Extension publication.

7. **L.K. Sharma**, J. Dwyer, A. Plant, and S.K. Bali. 2016. Inseason Nitrogen Recommendation Methods: A Review. ASA-CSSA-SSSA, Madison, WI (Oral).

8. **L.K. Sharma**, J. Dwyer, and A. Plant. 2016. Evaluate the Nitrogen, Calcium, and Boron Application Rates for Their Impact on Soft Rot, Yield, and Quality of Â“Russet BurbankÂ”. ASA-CSSA-SSSA, Madison, WI (Oral).

9. **L.K. Sharma** and J. Jemison Jr. 2016. Developing Nurse Crop Practice in Potato Cultivation System. ASA-CSSA-SSSA, Madison, WI (Poster).

10. **L. K. Sharma**, D.W. Franzen, E. C. Shultz, and Bu, H. 2016. In-Season N Management Tools in Commercial Cultivation System. ASA-CSSA-SSSA, Madison, WI (Oral), Invited Speaker.

11. **Sharma L.K.** 2015. Using ground-based active Sensors to direct in-season N application for corn in North Dakota. Soil and soil water workshop.

12. E. Schultz, **L.K. Sharma**, C. Graham, and D.W. Franzen. 2015 Nitrogen and Phosphorus Recalibration for Modern Varieties of Sunflowers for the Northern Great Plains. ASA-CSSA-SSSA, Madison, WI (Poster).

13. Franzen, D.W., E. Schultz, and **L.K. Sharma**. 2015. Nitrogen and Phosphorus Recalibration for Sunflowers in the Dakotas. National Sunflower Association Meeting.

14. Franzen, D.W., and **L.K. Sharma.** 2015. Using ground-based active Sensors to direct in-season N application for corn in North Dakota. Precision Ag Summit.

15. **Sharma L.K.** 2014. Algorithms for use in directing in-season N rates for corn. Soil and soil water workshop.

16. Franzen, D.W., **L.K. Sharma,** and H. Bu. 2013. Split application of N on sugarbeet and update on the use of active-optical sensors for sugarbeet yield and quality prediction. 44th Annual Sugarbeet Research Reporting Session, National Sunflower Association Research Forum 2013 at Fargo, ND (Poster).

17. Franzen, D.W., **L.K. Sharma,** and H. Bu. 2013. Nitrogen rate revision for corn in North Dakota - A preview of coming N fertilization strategies. North Central Soil Fertility Meeting at Des Moines, Iowa (Poster).

18. Bu, H., D.W. Franzen, and **L.K. Sharma**. 2013. Crop yield relationship to remote sensing data using intensified weighted nonlinear regression models. North Central Soil Fertility Meeting at Des Moines, Iowa (Poster).

19. Franzen, D.W., H. Bu, and **L.K. Sharma.** 2013. Relationship of active-optical sensor readings with sugarbeet yield and quality, sunflower yield and spring wheat grain protein. The International annual meeting, November 3-6, Tampa, Florida. ASA-CSSA-SSSA, Madison, WI (Poster).

20. Franzen, D.W., and **L.K. Sharma.** 2013. Active-Optical Sensor Algorithms for Corn Yield Prediction and In-Season N Application in North Dakota. Paper and presentation-International Conference on Precision Agriculture, Indianapolis, IN (Oral).

21. Bu, H., D.W. Franzen, and **L.K. Sharma**. 2013. Crop yield relationship to remote sensing data using intensified weighted nonlinear regression models. International annual meeting, November 3-6, 2013, Tampa, Florida. ASA-CSSA-SSSA, Madison, WI (Poster).

22. **Sharma L.K.** and D.W. Franzen. 2013. Performance of two commercially available ground-based active optical sensors, Greenseeker® (TM) and Holland Scientific Crop Circle Sensor® ACS 470, for their ability to estimate corn (Zea mays, L.) yield over two years. Research and Arts Forum, NDSU, April 11, 2013 (Poster).

23. **Sharma L.K.** and D.W. Franzen. 2013. Evaluation of red and red-edge NDVI from ground-based active optical sensors for corn yield prediction over two years under different

soil type texture and tillage categories. Oral presentation, International annual meeting, November 3-6, 2013, Tampa, Florida. ASA-CSSA-SSSA, Madison, WI (Oral).

24. **Sharma L.K.** and D.W. Franzen. 2013. Relationship of corn height, active optical sensor readings and corn yield under different soil surface textures in North Dakota. Canadian Society of Soil Science annual meeting, July 22-25, 2013, Winnipeg, Canada (Poster).

25. **Sharma L.K.**, M. Kaushal, S.K. Bali, M.I.S. Gill, O.P. Choudhary, and J. Saini. 2013. Survival of Rough Lemon (*Citrus jambhiri* Lush.) Seeds Under in Vitro Saline Conditions. Poster presentation, International annual meeting, November 3-6, Tampa, Florida. ASA-CSSA-SSSA, Madison, WI (Poster).

26. **Sharma L.K.** and D.W. Franzen. 2012. Comparison of two commercial active optical sensors regarding their relationship between early-season sensor readings and final corn (Zea mays, L.) yield. Poster in the International annual meeting, October 21-24, 2012, Cincinnati, Ohio. ASA-CSSA-SSSA, Madison, WI (Poster).

27. Franzen, D.W., and **L.K. Sharma.** 2012. Improvement of Corn Yield and Sensor Reading Relationship with Consideration of Crop Height. Poster in the International annual meeting, October 21-24, 2012, Cincinnati, Ohio. ASA-CSSA-SSSA, Madison, WI (Poster).
28. Franzen, D.W., and **L.K. Sharma.** 2012. Use of corn height to improve the relationship between active optical sensor readings and yield estimates. Paper and presentation-International Conference on Precision Agriculture, Indianapolis, IN (Oral).

29. Franzen, D.W., and **L.K. Sharma.** 2012**.** Use of active optical sensors in North Dakota. Nitrogen Use Efficiency Conference, Fargo, 2012 (Oral).

Unpublished Professional Presentations

1. **L.K. Sharma**. 2017. Annual Rye Grass Research. McCain Foods farmer meet. March 2017.

2. **L.K. Sharma**. 2017. Fertilization and Liming in Soil. Soil and Agronomy Workshop February 8, 2017, UMPI campus center.

3. **L.K. Sharma**. 2017. Improving Farm Income: Rotation Crops and Potato Irrigation. Soil and Agronomy Workshop February 8, 2017, UMPI campus center.

4. **L.K. Sharma**. 2017. Improving nitrogen use efficiency. Maine potato conference, Caribou, ME.

5. **L.K. Sharma**. 2017. What is site-specific agriculture? Maine potato conference, Caribou, ME.

6. **L.K. Sharma**. 2017. Predicting potato yield and quality using optical sensors. CCA training workshop New Hampshire February 2, 2017.

7. **L.K. Sharma**. 2016. Tillage Management in Potato and Grain Crops. Potato Conference January 22-23, 2016, Caribou Inn and Convention Center.

8. **L.K. Sharma**. 2016. Sensor to assess vegetable fertility. CCA training workshop New Hampshire February 2, 2016.

9. **L.K. Sharma**. 2016. Nurse crop benefits and its implications. 2016. Aroostook Extension Staff meeting.

10. **L.K. Sharma**. 2016. Potato fertility and its impact on yield and quality. 2016. Aroostook Extension Staff meeting.

11. **L.K. Sharma**. 2016. "Role of Precision Ag in Agronomy." UMPI's science seminar series 2016.

12. **L.K. Sharma**. 2016. The role of Precision Ag about Soils and Agronomic Crops. Soil and Agronomy Workshop February 8, 2016, UMPI campus center.

13. **L. K. Sharma**. 2016. Role of precision ag and nurse crop in potato cultivation at Roger's Farm field day.

14. **L.K. Sharma**. 2016. Evaluating different fertilizer for their role maintaining potato yield, health, and quality at Aroostook Research Farm Field Day.

15. **L.K. Sharma**. 2015. What is site-Specific farming? Pest Management Conference December 2, 2015, Presque Isle Inn and Convention Center.

16. **L.K. Sharma**. 2015. Use of active optical sensors in grains. Soil water conservation conference. Fargo, ND.

17. **L.K. Sharma**. 2014. Improving crop yield and quality through precision agriculture. Soil water conservation conference. Fargo, ND.

18. **L.K. Sharma**. 2013. Developing nitrogen calculation algorithms for corn and wheat. Soil water conservation conference. Fargo, ND.

RESEARCH AND EXTENSION EXPERIENCE:

Assistant Professor, University of Maine, 2015-2017

- **Project: "Development of Advance Phosphorous Recommendations for Maine Potato Growers" with S.K. Bali and J.D. Dwyer,** University of Maine Cooperative Extension. The University of Maine Cooperative Extension will develop soil and climate based phosphorus (P) recommendations, to improve nutrient use efficiency and reduce grower's input cost with environmental issues as well e.g. eutrophication of lakes and rivers due to P pollution. Objectives of this study are to create robust grower specific P recommendations, with multiple sites that will include varied soil textures, soil moisture,

and weather conditions. Yield, quality, soil moisture, weather data, P uptake, tissue sampling, and soil physical, chemical, and biological data will be used for this study. A ground-based active optical (GBAO) sensor will be used to monitor plant health, and adjust fertilizer application, which may help in developing yield prediction models. There will be significant outcomes from this study. An online mobile application will be prepared where growers will be able to access required P rates for his field using maximum yield potential, soil type, and closest weather station. It will help in managing P variably, which will benefit in reducing its application rates. Since recommendations will be economical using potato size, and other quality parameters, growers will be able to decide whether additional P application will improve their revenue.

- **Project: "Demonstrating effects of fly ash on agriculture production and soil amendments at a reduced cost" with S.K. Bali,** University of Maine Cooperative Extension. Demonstrate and quantify the impacts of fly ash as amendments on soil chemical, physical, biological, and climatic properties and their relationships with nutrient uptake, and plant growth at a reduced cost. Fly ash will be utilized as a value added product for agriculture and would like to give farmers a better opportunity to save some money and reduces environmental and economic impacts of disposal.

- **Project: Evaluate different N fertilizers to improve nitrogen use efficiency, potato yield, and quality of rainfed and irrigated fields" with S.K.Bali and J.D. Dwyer,** University of Maine Cooperative Extension**.** Ammonium sulfate is most common fertilizer used in Maine as sole or in combination with ammonium nitrate or DAP, but it has potential to create acidic soils. Despite its significant contribution towards soil acidity, it is common among Maine grower's results in high input cost to increase soil pH. Ammonium sulfate is common due to its slow N release characteristic, but we could use other N fertilizer to provide sufficient N to potatoes throughout its growth period. In this study, we will be establishing two research trials under dry and irrigated land using several different n fertilizers alone or in combination. The objective of this study is to evaluate various N sources for their impact on productivity, quality, and chemical composition of potato while applying with or without nitrification inhibitor insole or combined applications. We will also test N response under dry and irrigated area. Sensors were able to predict yield in 2016. Thus it will be important to compare their abilities to both dry and irrigated fields. The outcome of this research will be that Maine might have an alternative fertilizer comparative to ammonium sulfate which would help in reduced expenditure on liming. We are also hypothesizing that using slow release fertilizer might help in improving yield and quality of potatoes. Although we would need more data to develop inseason sensor based N recommendations but using this data we will be able to send out some guidelines of using sensor technology.

- **Project: "Developing advanced nitrogen recommendations for potatoes" with S.K.Bali and J.D. Dwyer,** University of Maine Cooperative Extension. Using optical sensors and drone to detect nitrogen deioffciencies in potatoes and devlop guidelines for potato growers on how to interpret the results and incoporate them in their nitrogen application rates.

- **Project: "Investigating methods of preventing soil loss in a potato: grain rotation system using cover and nurse crops" with J. Jemison,** University of Maine Cooperative Extension. The guidelines were devloped for Maine potato growers to use cereal rye or other grains as portective measure against soil erosion by high intesity rainfall after potato plantng when there is no cover for soil.

Post-Doctoral Fellow, North Dakota State University, 2014-2015

- **Project: "Develop advance pre-planting N and P recommendations in sunflower under Northern Great Plains and improve in-season N application strategies in sunflower using active optical sensors" with D.W. Franzen and Eric Shultz, 2014-August 2015.** Develop pre-planting and inseason N recommendation for sunflower for North Dakota and South Dakota growers. Fifteen research sites were established and maintained throughout the growing using season. Sites were screened for low, medium, high N to develop a robust recommendation. Soil sampling before planting and during planting for macro-micro nutrient analysis. Trimble-Greenseeker® and Holland Crop-Circle® sensors were used at V6 and V12 stage of sunflower. Potential N deficiency in control plots was detected. SenixView a height sensor were also used in both V6 and V12 stage for plant height measurement. After harvesting sunflower, yield data was used to develop correlation equation for yield prediction models.

- **Project: "Estimating wheat protein content early in the season to control its percentage in grain along with N application" with Joel Ransom and D.W. Franzen, 2014-August 2015.** The project goal was to develop in season N recommendation for wheat. Trimble-Greenseeker® and Holland Crop-Circle® sensors were used at Flag leave stage of wheat. Yield are sensor data analyzed for yield and protein prediction models.

- **Project: "Evaluation of Soil Potassium Test to Improve Fertilizer Recommendations for Corn" with D.W. Franzen, Manbir Rakkar, Eric Shultz, and John Breaker, 2014-August 2015.** The dry soil sample is used soil potassium test. However, the test number differs from the same sample, when soil is moist. To address this issue, 12 research sites were established and with different potassium rate. Soil samples were taken every 15 days interval from each location. Wet and dry soil test was performed, where a different number were found. A wet soil test recommendation was developed along with new potassium recommendation at planting.

- **Project: "Multi State-Project on corn N recommendation" with D.W. Franzen, Richard Ferguson, Newell Kitchen, North Dakota State University, University of Nebraska and University of Missouri 2014-August 2015.** Eight states were involved in developed new crop model for corn for efficient N recommendations. Two research sites were established on different soil type in North Dakota using sensor based inseason N application. Weather and soil moisture data were collected to incorporate it into the model to develop a better sensor-based N recommendations. Leaf and plant samples were also analyzed for N prediction model.

- **Project: "BASF-anhydrous Ammonia study" with D.W. Franzen and BASF staff, 2013-August 2015.** One corn sites established to evaluate anhydrous ammonia mixed with

BASF chemical. The site was managed to detect nutrient deficiency. Sites were soil samples and plant samples to detect nutrient deficiency and potential disease problems.

- **Project: "Nitrogen inhibitor study" with D.W. Franzen, 2013- August 2015.** Three research sites were established, spring wheat, winter wheat, and corn to evaluate new fertilizer from BASF name Limus. Sites were soil samples and plant samples to detect nutrient deficiency and potential disease problems.

Graduate Student (Ph.D.), North Dakota State University, 2011-2014

- **Project: "Evaluation of active optical ground-based sensors to detect early nitrogen deficiencies in corn" with D.W. Franzen, R. J. Goos, T. M. DeSutter, and J. K. Ransom, North Dakota State University, 2011-2014.** Economical dollar based pre-planting and side dress nitrogen recommendations depend on cultivation system, and soil type in corn for North Dakota Growers was developed. Active optical sensors were used at V6 and V12 stage, when corn takes about 70% of applied nitrogen, to develop an algorithm for nitrogen recommendation on the go.

- **Project: "In-season yield and quality prediction and nitrogen recommendations in corn, sugarbeet, spring wheat and sunflower using ground-based optical sensors and satellite imagery" with D.W. Franzen and Honggang Bu, North Dakota State University, 2012-December 2014.** Evaluate the use of ground-based active optical sensors (Trimble-Greenseeker® and Holland Crop-Circle®and Senix® acoustic height sensors). Develop yield models for corn, wheat, sunflower, and sugarbeet. Detect early nitrogen deficiencies in corn. Published peer-reviewed journals and extension outlets. Compare satellite imagery with ground-based active optical sensors.

- **Project: "Three State-Project" with D.W. Franzen, Laura Stevens*, Honggang Bu, the *University of Nebraska and North Dakota State University, 2012-2014.** Installed and managed two weather stations for data collection every week to correlate it with nitrogen response curve. Active optical sensor data was collected, processed and sent it to University Nebraska-Lincoln to compare it with USDA N recommendation model.

- **Project: "Long-term tillage studies in Fargo-Ryan silty clay loam soils" with D.W. Franzen, A. Chatterjee, and N. Cattanach, Honggang Bu at North Dakota State University, 2011-2014.** Establish and mange one site with three crop rotations includes sugarbeet, corn, and soybean. Yield data and soil samples were collected for potential nutrient mineralization and N loss. The whole experiment was established on high clay soil. Soil compaction data was analyzed to detection soil compaction due no-till, strip till, and conventional activities.

Research Fellow, Punjab Agricultural University, 2008-2010

- **Project: "Protection of Plant Varieties, Farmers Rights Act, and Training in North INDIA CCS-33" with Sandeep Kapur and Ramesh Kumar Number, Department of plant breeding and genetics, Punjab Agricultural University, Ludhiana, March 2008-August 2010.** A collection of plant sample of different varieties of crop plants at various locations within North India. Organized training workshops and meetings for members and

facilitated meetings. Conducted field surveys for identification of crop varieties. Delivered lectures on farmer's rights at various region research stations as well as townships. Informed farmers about the new diseases, new varieties, new cultivation system (zero tillage), new farming technologies (potato seeder), and produced seedling potatoes. Diagnosed their fruit nutrient deficient production problems and marketing strategies. Took part in small farmer diversification program help small landholder to grow nurseries for hybrid seed production for the major vegetable crop as well as virus-free kinnow nursery production. Assisted the farmers in the identification, certification, and registration program for cataloging of their varieties. Statistical analysis and synthesis of data and prepare project reports. Published in peer-reviewed journals and extension outlets. Presented findings at academic conferences and extension events. Collaborated with the university extension system to disseminate the brochures and required information regarding the project. Responded to farmer inquiries.

- **Project: "Cellular and transgenic applications for salinity tolerance in rough lemon (*Citrus jambhiri* Lush)" with M. I. S. Gill, H. S. Rattan Pal, and O.P. Choudhary, School of Agricultural Biotechnology and Department of Soils, Punjab Agricultural University, Ludhiana, August 2008-August 2010.** Evaluated the most common citrus rootstock, rough lemon (*Citrus jambhiri* Lush.), for Salinity Tolerance under the greenhouse. Standardize the salt content for rough lemon under greenhouse conditions. Evaluated soil- EC, available N, P, K, Na, K, Ca, Cl and other macro and micronutrients in soil and plant. Published in peer-reviewed journals and extension outlets. The findings were presented at academic conferences and extension events. Installation of Gamma chambers in the university. Trained undergraduate assistants in tissue culturing and greenhouse management skills. Lectured undergraduate students on tissue culture and greenhouse benefits during winter.

- **Project: Development of Resistance to Phytophthora in rough lemon (*Citrus jambhiri* Lush) with M. I. S. Gill, H. S. Rattan Pal, and O.P. Choudhary, School of Agricultural Biotechnology and Department of Soils, Punjab Agricultural University, Ludhiana, August 2008-August 2010.** Collected the seeds from healthy plants and plant them under greenhouse after infecting with the Phytophthora. Evaluated the most common citrus rootstock, rough lemon (*Citrus jambhiri* Lush.), for Phytophthora resistance under greenhouse conditions. Presented findings at academic conferences and extension events. Trained undergraduate assistants for data collection and in tissue culture techniques.

Master's Research, Punjab Agricultural University, 2005-2007

- **Project: To standardize the nursery production in especially in kinnow mandarin (*Citrus reticulata* Blanco) growing area of India, "Evaluate the direct sown and transplanted rough lemon (Citrus jambhiri Lush.) seedlings under modified environmental conditions" with H.S. Dhaliwal, M.I.S. Gill, H.S. Rattan pal, and Seema Bedi, Department of Fruit Science and Department of Botany, Punjab Agricultural University, Ludhiana, India, 2005-2007.** Managed greenhouse, glasshouse, shade net house, and screen house for nursery plants. Applied appropriate fertilizer, herbicide, and insecticide. Maintained appropriate sanitation conditions. Delivered lectures to the visiting farmers about the virus free nursery production. Worked as primary

extension personnel during the biggest farmer fair round INDIA at Punjab Agricultural University. Data collection and plant transfer from one site to another for treatment application. Analyzed data using Regression, Correlation, and ANOVA statistics in CPCS1 and Microsoft Excel. Published peer-reviewed journals and extension outlets. Presented findings at academic conferences and extension events.

- **Project: "Standardization of pruning intensity in Kinnow mandarin (*Citrus reticulata* Blanco) for the production of healthy bud wood" with H.S. Dhaliwal, A.K. Banke, M.I.S. Gill, H.S. Rattan pal, and Seema Bedi, Department of Fruit Science and Department of Botany, Punjab Agricultural University, Ludhiana, India, 2005-2007.** Managed big tree plants under greenhouse conditions. Applied appropriate fertilizer, herbicide, and insecticide. Maintained appropriate sanitation conditions. Pruned the plants at adequate levels. Data analysis, interpretations, and its practical applications.

Undergraduate Research, Guru Nanak Dev University, 2001-2005

- **Project: "Detect the fertility issues in African Sarson (Brassica Carinata A. Br.)" with Rakesh Kumar, and Deanpal Singh, Khalsa College, Department of Agriculture, Guru Nanak Dev University, Amritsar, 2001-2005.** Timely nitrogen application to study its effect on final yield. Manage the fields throughout its growing season. Analyze the data and write the report.

CONFERENCES AND WORKSHOPS ATTENDED:

- Ag Expo 2014 at Fargo Dome, North Dakota State University (helped organize).
- International nitrogen use efficiency conference 2014 at South Dakota State University.
- International ASA, CSSA, and SSSA conference 2013, at Tampa Florida.
- International Canadian Soil Science Annual Meeting at Winnipeg, Manitoba, July 2013.
- International nitrogen use efficiency conference 2013, Johnston, Iowa.
- International nitrogen use efficiency conference 2012, at Fargo, North Dakota.
- International ASA, CSSA, and SSSA conference 2012, at Cincinnati, Ohio.
- International conference on sustainable agriculture for food and livelihood security, November 27-29, 2012, Ludhiana, Punjab, India.
- Soil and Soil Water Workshop for CCA's, Fargo, ND, January 15, 2013.
- Western Crop and Pest Management School workshop at Mandan February 27, 2013.

SKILLS:

- **Leadership:** Participation in multiple teams providing experience in communication, collaboration, leadership, and conflict resolution. (IPR project team, N Management Project, Advertising Officer, undergraduate and graduate student supervision and supervising our summer research crew).

- **Computer & Technical:** Experience with Macintosh and Windows. Proficient knowledge of SAS statistical software, JMP, and CPCS1. Technical skills include active optical sensor

calibration and operation, weather station calibration and installation, soil and plant N, P, K, Zn, pH, analysis, gas chromatography, basic tractor and agricultural machinery skills.

- **Languages:** Fluent in English, Punjabi, and Hindi (written and verbal).

- **Cultural Understanding/Sensitivities:** Comprehensive travel and living, including South, North, and Central America, North India, and Canada.